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Physico-chemistry of energy-dense Li1.2Mn0.52Co0.13Ni0.13Al0.02O2 cathode material for lithium-ion batteries obtained from urea and ethylene glycol fuels

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Abstract

A lithium manganese rich-transition metal oxide, Li1.2Mn0.52Co0.13Ni0.13Al0.02O2 (LMNCA) cathode was successfully prepared by the combustion method with urea (i.e., LMNCA-urea) and ethylene glycol (EG) (i.e., LMNCA-EG) used as fuels. The effects of the combustion fuels on the physical (XRD, XPS, Raman, FE-SEM and BET) and electrochemical properties of the samples were thoroughly evaluated. Both LMNCA samples exhibit a highly ordered crystalline 'layered-layered' structure. LMNCA-urea delivered a highest specific capacity of 295 mAh g-1 with the capacity retention of 84% after 50 cycles, while the LMNCA-EG gave a specific capacity of 240 mAh g-1 (capacity retention of 78%) after 50 cycles. However, the EG-based combustion synthesis suppresses voltage decay by its ability to prevent the undesirable transformation of the layered-layered phase to the layered-to-spinel phase upon continuous cycling and improves the charge-transfer kinetics of the LMNCA. The results provide a promise that EG-based combustion can be tuned to provide high-performance LMNCA for future application.